

## Personal Experience Summary of DR. GARY S. SETTLES

### PERSONAL

Office: 301D Reber Bldg., University Park, PA 16802; (814) 863-1504. Home: 2053 Valley View Road, Bellefonte, PA 16823; (814) 355-7093. Born October 9, 1949. Citizenship: USA. Married.

### EDUCATION

- Princeton University, Ph.D., January 1976, Aerospace and Mechanical Sciences.
- University of Tennessee (Knoxville), B.S. 1971, Mechanical and Aerospace Engineering.
- Maryville High School, Maryville, TN, graduated 1967.

### EXPERIENCE

July 1983 to present: Pennsylvania State University, Mechanical Engineering Dept., University Park, PA: Professor and Director, Gas Dynamics Laboratory. Established Gas Dynamics Laboratory for experimental high-speed fluid dynamics research. Principal Investigator of research grants from NASA, AFOSR, ONR, DOE, NSF, FAA and several industries totaling over \$500,000/year on atomization and sprays, environmental fluid dynamics, explosive detection technology, shock/boundary layer interaction phenomena, supersonic mixing and vortex breakdown, flow visualization, industrial clean-room fluid dynamics, and the gas dynamics of advanced materials and manufacturing processes. Taught ME 33 (Fluid Mechanics), ME 497C (Compressible Flow I, later ME 434), and ME 519 (Compressible Flow II). Supervised many MSE and Ph.D. students' research programs. Senior Member of the Graduate Faculty and former member of the PSU Graduate Council.

May 1977 to July 1983: Princeton University, Mechanical and Aerospace Engineering Department, Princeton, NJ: Research Engineer and Lecturer; Manager, Gas Dynamics Laboratory. Co-Principal Investigator on several experimental studies of two- and three- dimensional turbulent boundary layer/shock wave interaction flows. Manager of Gas Dynamics Laboratory operations, contracts, and staff. Supervised the research programs of seven graduate and two undergraduate students. Taught the Laboratory section of MAE 335 (Compressible Fluid Flow), and MAE 512 (Experimental Methods).

July 1975 to May 1977: Princeton Combustion Laboratories, Division of Flow Research, Inc., Princeton, NJ: Research Scientist. Project Leader of a study to define a national program in energy-efficient pump utilization; duties involved technical contribution to the study, project management, supervision and coordination of the work of a ten-member Technical Consulting Group. Co-investigator on experimental projects involving the design, construction, and operation of a ballistic-piston gas compressor and the detonation of a fuel-air cloud by means of pyrophoric compounds. Investigator of a study of handling sensitivity of malfunctioned primers, involving high-speed photographic observation of explosive events.

July 1971 to July 1975: Princeton University, Aerospace and Mechanical Sciences Department, Gas Dynamics Laboratory, Princeton, NJ: Assistant in Research and Teaching. Involved in graduate program of study and research leading to the Ph.D. degree; Research topic: compressible turbulent boundary layers, shock wave interactions, and flow separation; Advisor: Prof. S. M. Bogdonoff. Served as teaching assistant in undergraduate fluid mechanics and thermodynamics courses.

Summer 1970: NASA Ames Research Center, Air-Breathing Propulsion Branch, Moffett Field, CA: Engineering Aide. Developed and applied two new optical flow measurement techniques to experiments in supersonic and hypersonic airflows. Was involved with work on numerical codes for turbulent boundary layer prediction and hypersonic testing of airbreathing inlet configurations.

Summer 1968 and 1969: The Boeing Company, Commercial Airplane Division, SST Aerodynamics Group and Advanced 747 Configurations Group, Seattle, WA: Student Engineer. Involved in analysis and test planning for elastic forebody loads and crossflow lift of the supersonic transport. Involved in wing and airfoil design and wind tunnel testing of the advanced 747 airplane configuration. Carried out design study for wing tip tank installation on 747.

Summer 1967: U. S. Naval Ordnance Laboratory, Aeroballistics Division, White Oak, Silver Spring, MD: Physical Science Aide. Involved in high speed wind tunnel testing and optical flow analysis. Assisted with experiments carried out in supersonic and hypersonic wind tunnels, shock tube, and aeroballistic range.

## HONORS AND AWARDS

1966 - Named to Honors Group, Westinghouse Science Talent Search

1967 - Awarded 3rd Place, NASA Award, Air Force Achievement Award, and Navy Science Cruiser Award at the International Science Fair, San Francisco, CA.

- Awarded ALCOA Scholarship

- Appointed by Governor of Tennessee as State Delegate to National Youth Science Camp, Greenbank, WV.

1970 - Awarded AIAA National Undergraduate Student Award for research in flow visualization.

1971 - Awarded NSF Traineeship

1986 - Awarded Penn State Engineering Society (PSES) Award for Outstanding Research

1986 - Awarded AIAA Service Citation for Associate Editorship of AIAA Journal, 1983-1985.

1986 - "Outstanding Young Men of America" Award

1987 - Elected Associate Fellow of AIAA

1990 - Awarded Departments Head's Outstanding Faculty Award, M.E. Dept., Penn State

1992 - Awarded Penn State Engineering Society (PSES) Premiere Researcher Award

2003 - Paper of the Year Award, *Journal of Thermal Spray Technology*, (with co-authors T. C. Hanson and C. M. Hackett)

2004 - ASME Freeman Scholar Award

2004 - Awarded the Tsuyoshi Asanuma Award for Outstanding Achievement in Flow Visualization by the Visualization Society of Japan

2005 - Award for Excellent Visualized Image in 2005 (Full-scale schlieren image of a rifle discharge) by the Visualization Society of Japan

2007 - Given the title of Distinguished Professor by Penn State University

2007 - Awarded the Science Writing Award for Professionals in Acoustics by the Acoustical Society of America

## PROFESSIONAL SOCIETIES/ACTIVITIES

Member: American Institute of Aeronautics and Astronautics (AIAA, Associate Fellow), American Society of Mechanical Engineers (ASME), Sigma Xi, American Physical Society (APS), Society of Photo-Optical Instrumentation Engineers (SPIE), Intl. Soc. for the Arts, Sciences and Technology (ISAST), American Society of Engineering Education (ASEE), American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)

○ AIAA: Associate Editor, AIAA Journal, 1983-85. General Chairman, AIAA 16th Fluid & Plasma Dynamics Conference, 1983. Member of Fluid Dynamics Technical Committee 1980-83. Treasurer, Princeton Section 1980-82. Past Technical Program Committee Member, Conference Session Chairman, and Reviewer for numerous AIAA meetings and publications since 1974. National Student Award Winner 1970. Elected Associate Fellow 1987.

○ Member of AGARD Working Group 18 - Subcommittee on Shock Wave/Boundary-Layer Interaction and Transition, 1991-1993.

○ Member of the Supersonic Tunnel Association, 1977-1983 and 1989-1994.

○ Member of International Program Committee, 3<sup>rd</sup> through 13<sup>th</sup> International Symposia on Flow Visualization, 1983-2008.

## PAST AND PRESENT INDEPENDENT RESEARCH ACTIVITIES

○ President of FLOVIZ, Inc., a small business devoted to research and engineering in fluid dynamics.

○ Consultant to United Technologies Research Center on transonic shock wave/boundary layer interactions and flow visualization for wind tunnel testing.

○ Consultant to IBM Corp. on clean-room aerodynamics, flow visualization, and contamination control.

○ Consultant on 3-dimensional flow visualization to the Boeing Aerodynamics Laboratory.

○ Consultant to the Singer Co., American Meter Division, on the development of a natural gas energy meter.

○ Consultant to Ketron, Inc., on the fluid mechanics of mine ventilation.

○ Consultant to Nassau Research, Inc., on fluid flow problems of acetylene torches.

○ Consultant to Princeton Combustion Research Laboratories on problems of industrial energy conservation and experimental and computational fluid mechanics.

○ Consultant to the Rosenblad Corporation on the fluid mechanics of large industrial equipment.

○ Consultant to Ion Track Instruments on airborne sampling of trace explosives

○ Author of many articles on engineering and physics for The Academic American Encyclopedia and Collier's Encyclopedia.

○ Contributor on scientific photography, fluid mechanics, and combustion to various publications, museum exhibits, films, and television series including Scientific American, OMNI, Science Digest, Science et Vie, Newsweek, the Franklin Institute, the award-winning film "Search for Solutions", the CBS science series "Universe", the NBC "Today Show," and CNN's "Science News." Schlieren photography work was also featured in the series "Scientific Imagery", on German Public Television (NDR), and in The Learning Channel's Series "Body Atlas." Most recently, the world's largest stereoscopic schlieren system was set up to produce footage for the 1997

3D IMAX film "Hidden Dimension" Color schlieren photographs of the human cough, gunshots, and other phenomena have been reproduced in hundreds of books, magazines, and newspapers around the world.

#### **JOURNAL AND PROPOSAL REVIEWER**

AIAA Journal  
European Journal of Physics  
Experiments in Fluids  
Journal of Biochemical and Biophysical Methods  
Journal of Fluid Mechanics  
Journal of Fluids Engineering  
Journal of Thermal Spray Technology  
Journal of Turbulence  
Measurement Science and Technology  
NSF Chemical & Thermal Systems  
Optical Engineering  
Review of Scientific Instruments  
Particle and Particle Systems Characterization  
Shock Waves  
US Dept. of Energy Basic Energy Sciences Program

#### **INVITED LECTURES AND SEMINARS**

○ Seminar entitled "A Review of Experimental Research at the Princeton Gas Dynamics Laboratory", was presented in various versions at:

California Institute of Technology (February 1981)  
United Technologies Research Center (March 1981)  
University of Tennessee Space Institute (August 1981)  
University of Texas (January 1982)  
Lockheed-Georgia Co. (August 1982)  
Pennsylvania State University (March 1983)

○ Invited Survey Lecture entitled "The State-of-the-Art of Conventional Flow Visualization Techniques for Wind Tunnel Testing," presented at the NASA Workshop on Flow Visualization and Laser Velocimetry for Wind Tunnels, Hampton VA, March 1982.

○ Seminar entitled "Some Unusual Fluid Phenomena Visualized by the Schlieren Technique", presented at Rutgers University, October 1982.

○ Invited Keynote Lecture on "Flow Visualization Techniques for Practical Aerodynamic Testing," Presented at the Third International Symposium of Flow Visualization, Ann Arbor, MI, September 1983.

○ Seminar entitled "White-Light Pseudo-Color Encoding Optics for Flow Visualization," presented at Penn State Electrical Engrg. Dept., October 1983.

○ Invited Survey Lecture entitled "Modern Developments in Flow Visualization," presented at AIAA 17th Fluid and Plasma Dynamics and Lasers Conference, Snowmass, CO, June 1984.

○ Invited Lectures on Shock/Boundary Layer Interactions and Flow Visualization were presented at the Beijing Institute of Aeronautics and Astronautics and the Beijing Institute of Aerodynamics, Beijing, China, July 1984.

○ Seminar Entitled "Visualization of Human Aerobiological Flows," presented at Hershey Medical Center, October 1984, and Penn State Chemical Engrg. Dept., February 1985.

○ Seminar entitled "Color Schlieren Flow Visualization and Applications", presented at San Diego State University, Fall, 1985.

- Invited lecturer, University of Michigan Summer Short Course entitled, "Flow Visualization Techniques: Principles and Applications", yearly, 1986 to 1990.
- Invited Paper (AIAA 86-1099), "Recent Skin Friction Techniques for Compressible Flows," presented at AIAA/ASME 4th Fluid Mechanics, Plasma Dynamics, and Lasers Conference, Atlanta, GA, May 1986.
- Invited Lecture on "Flow Visualization: Images from Thin Air," presented at Meeting of SAE Williamsport, PA Group, April 1986.
- Invited Seminar entitled "Flow Visualization in Microelectronics Manufacturing," presented at the IBM Thomas J. Watson Research Center, September 1987, and at IBM Federal Systems Division, October 1987.
- Invited seminar entitled "Shock/Boundary Layer Interactions, Flow Visualization, and Instrumentation," presented at the USAF Arnold Engineering Development Center, Tullahoma, TN, March 1987.
- Lehigh University Seminar in Engineering Science, "Application of Schlieren Optics in Fluid Mechanics and Heat Transfer," Feb. 20, 1987.
- Invited Paper entitled "Visualization of High-Speed Flows at the Penn State Gas Dynamics Laboratory," presented at the 1988 International Conference on Applications of Lasers and Electro-Optics, Santa Clara, Oct. 30, 1988, with Metwally, O. M., Hsu, J. C., and Lu, F. K.
- Invited Paper entitled "Swept Shock/Boundary-Layer Interactions -- Tutorial and Update," Invited AIAA Paper 90-0375, presented at the AIAA 28th Aerospace Sciences Meeting, Reno, NV, January 1990, co-authored with D. S. Dolling
- Seminar entitled "Swept Shock/Boundary-Layer Interactions and Their Control", was presented at the Boeing Aircraft Co., Seattle, April 1991, and at NASA-Lewis research Center, June 1991.
- Seminar entitled "A Review of Research at the Penn State Gas Dynamics Laboratory", was presented at:  
 Institute Saint-Louis, France (August 1991)  
 ONERA Chalais-Meudon Laboratory (August 1991)  
 DLR-Göttingen (August 1991)
- Seminar entitled "Schlieren Visualization of the Human-Body Thermal Plume," Mechanics & Fluid Mechanics Colloquium, Essen University, Germany, May 5, 1993.
- Keynote Lecturer in NATO/AGARD Special Course on Shock Wave/Boundary Layer Interactions in Supersonic and Hypersonic Flows," Brussels, Belgium, 24-28 May, 1993.
- Panelist, NSF National Young Investigator Selection (Fluid, Particulate, and Hydraulic Systems), March 1994.
- Seminar entitled "Schlieren and Shadowgraph Techniques; Whence They Come and Where They Are Headed," College of Engineering, Florida State University/Florida A&M University, Tallahassee FL, Jan. 14, 1998.
- Invited Lecture entitled "Non-Traditional Fluid Dynamics: Adventures Beyond the Realm," presented at:
  - American Physical Society, Division of Fluid Dynamics, 51<sup>st</sup> Annual Meeting, Nov. 22-24, 1998, Philadelphia, PA
  - Stanford University, Mechanical Engineering Dept., March 10, 1999.
  - University of Minnesota, Mechanical Engineering Dept., April 14, 1999.
  - Florida State and Florida A&M Universities, College of Engineering, Tallahassee, FL, April 17, 2001
  - University of Florida, Mechanical and Aerospace Engrg. Dept., March 18, 2004
- "Flow Visualization: New Tricks for an Old Dog" lecture presented at Bucknell University, Nov. 5, 1999.

○ Mechanical & Nuclear Engineering Faculty Distinguished Lecture, Jan. 24, 2002, "Seeing the Invisible at Penn State: A 20-Year Retrospective," Penn State University

○ The Joy Goodwin Lecture, entitled "The External Aerodynamics of Canine Olfaction," presented at the Auburn University College of Veterinary Medicine on March 5, 2002.

○ Seminar entitled "Shock Waves in Aviation Security and Safety," University of Virginia, October 18, 2001.

○ NASA Langley Research Center Colloquium, "Shock Waves in Aviation Security and Safety," Tuesday, June 4, 2002.

○ Sigma Public Lecture Series Presentation, "Shock Waves in Aviation Security and Safety," Tuesday, June 4, 2002, Virginia Air & Space Center, Hampton, VA.

○ Settles, G. S., "True Confessions of an Experimentalist," Invited Paper # 2003-4271, presented at AIAA Fluid Dynamics Conference, Orlando, FL, June 26, 2003.

○ "Sniffers," ASME Freeman Scholar Lecture, presented at the ASME IMECHE Conference, Anaheim CA, Nov. 2004. Also presented as an invited lecture at Syracuse University, Nov. 4, 2005.

○ Invited Lecture "High-speed imaging of shock waves, and small-scale blast testing of materials," presented at Lehigh University, April 7, 2006. A version of this lecture co-authored by student M. J. Hargather was also given at the US Army Research Laboratory in June 2006.

○ Invited Lecture entitled "The Aerodynamics of Canine Olfaction," presented at UC Berkeley, Neuroscience Dept., Oct. 2, 2006.

○ The William C. Reynolds Memorial Lecture, entitled "Fluid Mechanics and Homeland Security," presented at Stanford University Oct. 5, 2006.

○ Invited Lecture entitled "Sniffing Like a Dog to Improve Air Sensors," presented at Syracuse University, Oct. 30, 2006.

○ Invited Lecture entitled "The Aerodynamics of Canine Olfaction," presented at the *Gordon Research Conference on Detecting Illicit Substances: Explosives and Drugs*, September 16-21, 2007, Big Sky, Montana

## PATENTS

○ US Patent 5,578,581, G.S. Settles, Inventor, entitled "Supersonic Abrasive Iceblasting Apparatus," July 28, 1998, assigned to the Penn State Research Corp.

○ US Patent 5,975,996, G.S. Settles, Inventor, entitled "Abrasive Blast Cleaning Nozzle," November 2, 1999, assigned to the Penn State Research Foundation.

○ US Patent 6,073,499, G.S. Settles, Inventor, entitled "Chemical trace detection portal based on the natural airflow and heat transfer of the human body," June 13, 2000, assigned to the Penn State Research Foundation.

○ US Patent 6,171,656, G.S. Settles, Inventor, entitled "Method and apparatus for collecting overspray," Jan. 9, 2001, assigned to the Penn State Research Foundation.

## PUBLICATIONS

- M. J. Hargather, G. S. Settles, L. J. Dodson-Dreibelbis, and T. J. Liebner, "Natural-background-oriented schlieren imaging" to be presented at the 13th International Symposium on Flow Visualization, Nice, France, July 1-4, 2008.
- G. S. Settles, M. J. Hargather, M. J. Lawson, R. P. Bigger, and M. J. Madafis, "Schlieren imaging of shock waves in air at the extreme weak limit" to be presented at the 13th International Symposium on Flow Visualization, Nice, France, July 1-4, 2008.
- M. J. Lawson, G. S. Settles, J. D. Miller, and L. M. Weinstein, 'Focusing-schlieren "PIV" of supersonic turbulent boundary layers,' to be presented at the 13th International Symposium on Flow Visualization, Nice, France, July 1-4, 2008.
- M. M. Biss, G. S. Settles, and S. R. Sanderson, "Differential schlieren-interferometry with a simple adjustable Wollaston-like prism," accepted for publication in *Applied Optics*, 2008.
- G. S. Settles and M. J. Lawson, "Schlieren velocimetry of turbulent flows (Invited)," to be presented at the AIAA 38<sup>th</sup> Fluid Dynamics Conference, Seattle, June 2008.
- M. J. Hargather and G. S. Settles, "Optical measurement and scaling of blasts from gram-range explosive charges." *Shock Waves* Vol. 17 No. 4, pp. 215-223, 2007.
- J. Porter, B. A. Craven, R. M. Khan, S. J. Chang, I. Kang, B. Judkewicz, B. Judkewicz, J. A. Volpe, G. S. Settles, and N. Sobel, "Mechanisms of scent-tracking in humans, *Nature Neuroscience* Vol. 10 No. 1, pp.:27-29, 2007.
- Julian W. Tang and Gary S. Settles, "Coughing and infectious aerosols – Seeing is believing," submitted to *New England Journal of Medicine*, May 2007
- H. Kleine and G. S. Settles, "The art of shock waves and their flowfields," accepted for publication in *Shock Waves*, Dec. 2007.
- B. A. Craven, T. Neuberger, G. S. Settles, E. G. Paterson, A. G. Webb, E. M. Josephson, and E. E. Morrison, "Reconstruction and morphometric analysis of the nasal airway of the dog (*Canis familiaris*) and implications regarding olfactory airflow," *Anatomical Record* Vol. 290 No. 11, pp.1325-1340, 2007.
- Michael J. Hargather, Gary S. Settles, and Joseph A. Gatto, "Gram-range explosive blast scaling and associated materials response," Proc. 26th International Symposium on Shock Waves, July 15th-20th 2007, Göttingen, Germany.
- M.M. Biss, M.J. Hargather, G.S. Settles, L.J. Dodson, and J.D. Miller, "High-speed digital shadowgraphy of shock waves from explosions and gunshots," Proc. 26th International Symposium on Shock Waves, July 15th-20th 2007, Göttingen, Germany.
- M. E. Staymates, G. S. Settles, K.-B. Shi, and Z.-W. Liu, "Supercontinuum laser illumination applied to traditional optical flow imaging methods," *Optics Communications*, Vol. 273, 2007, pp. 252-255.
- J. Porter, B. A. Craven, S.-J. Chang, I. Kang, B. Judkewicz, R. M. Khan, J. A. Volpe, G. S. Settles, and N. Sobel, "Mechanisms of scent-tracking," *Nature Neuroscience*, Vol. 10, No. 1, January 2007, pp. 27-29.
- M. J. Hargather, G. S. Settles, J. A. Gatto, "Optical measurement, characterization, and scaling of blasts from gram-range explosive charges," *Proc. 4th International Aviation Security Technology Symposium*, Washington, DC, November 28-December 1, 2006.

- M. J. Hargather, G. S. Settles, J. A. Gatto, T. P. Grumstrup, and J. D. Miller, "Full-scale optical experiments on the explosive failure of a ULD-3 air cargo container," *Proc. 4th International Aviation Security Technology Symposium*, Washington, DC, November 28-December 1, 2006.
- M. E. Staymates, D. J. Smith, and G. S. Settles, "The internal aerodynamics of cargo containers for trace explosives sampling," *Proc. 4th International Aviation Security Technology Symposium*, Washington, DC, November 28-December 1, 2006.
- G. S. Settles, "On the fluid dynamicist as artist," *Proc. 12th International Symposium on Flow Visualization*, September 10-14, 2006, Göttingen, Germany.
- G. S. Settles, G. Tremblay, J. M. Cimbala, L. J. Dodson, and J. D. Miller, "Fluid mechanics films in the 21st century," *Proc. 12th International Symposium on Flow Visualization*, September 10-14, 2006, Göttingen, Germany.
- B. A. Craven and G. S. Settles, "A computational and experimental investigation of the human thermal plume" *Journal of Fluids Engineering*, Vol. 128, No. 6, November 2006, pp. 1251-1258.
- J. A. Volpe and G. S. Settles, "Laser-induced gas breakdown as a light source for for schlieren and shadowgraph "PIV," *Optical Engineering*, Vol. 45, No. 8, Aug. 2006, pp. 080509-1 to 080509-3.
- D. R. Jonassen, G. S. Settles, and M. D. Tronosky, "Schlieren 'PIV' for turbulent flows," *Optics and Lasers in Engineering*, Vol. 44, No. 3-4, pp. 190-207, 2006.
- G. S. Settles, "High-speed imaging of shock waves, explosions and gunshots," *American Scientist*, Vol. 94, No 1, pp. 22-31, 2006.
- G. S. Settles, "Fluid mechanics and homeland security," *Annual Review of Fluid Mechanics*, Vol. 38, pp. 87-110, 2006.
- B. A. Edge, E. G. Paterson, and G. S. Settles, "Computational study of the wake and contaminant transport of a walking human," *J. Fluids Eng.*, Vol. 127, No. 5, pp. 967-977, 2005.
- G. S. Settles, T. P. Grumstrup, J. D. Miller, and J. A. Gatto, Full-scale high-speed Edgerton shadowgraphy of explosions and gunshots," *Proc. 5th Pacific Symposium on Flow Visualization and Image Processing*, Daydream Island, Australia, 27-29 September, 2005
- S. P. Mates and G. S. Settles, "Experiments on Liquid Metal Atomization Using Close-Coupled Nozzles, Part 1: Gas Dynamic Behavior," *Atomization and Sprays*, Vol. 15, No. 1, pp. 19-40, 2005.
- S. P. Mates and G. S. Settles, "Experiments on Liquid Metal Atomization Using Close-Coupled Nozzles, Part 2: Atomization Behavior," *Atomization and Sprays*, Vol. 15, No. 1, pp. 41-59, 2005.
- G. S. Settles, "Sniffers: Fluid-dynamic sampling for olfactory trace detection in nature and homeland security – The 2004 Freeman Scholar Lecture," *J. Fluids Eng.* Vol. 127, No. 2, pp. 189-218, 2005.
- G. S. Settles, L. J. Dodson, "Full-scale schlieren visualization of supersonic bullet and muzzle blast from firing a .30-06 rifle," *Journal of Visualization*, Vol. 8, No. 1, 2005, p. 6.
- G. S. Settles, T. P. Grumstrup, L. J. Dodson, J. D. Miller, and J. A. Gatto, "Full-scale high-speed schlieren imaging of explosions and gunshots," *Proc. 26th Intl. Conf. on High-Speed Photography and Photonics*, Alexandria, VA, Sept. 20-24, 2004, D. L. Paisley, ed., Bellingham, WA: SPIE Press. Paper 5580-174, pp. 60-68.



- G. S. Settles, "The Penn State Full-Scale Schlieren System," Proc. 11<sup>th</sup> International Symposium on Flow Visualization, ed. T. J. Mueller and I. Grant, Notre Dame University, August 2004, paper 76.
- Settles, G. S., Benwood, J. R., and Gatto, J. A., "High-Speed Cinematography of Internal Explosions for Aviation Security," presented at the 24<sup>th</sup> International Symposium on Shock Waves, Beijing, July 2004.
- B. H. Pandya, G. S. Settles, and J. D. Miller, "Schlieren Imaging of Shock Waves from a Trumpet," *J. Acoustical Soc. America*, Vol. 114 Part 1, No. 6, Dec. 2003, pp. 3363-3367.
- Hanson, T. C. and Settles, G. S., "Particle Temperature and Velocity Effects on the Porosity and Oxidation of an HVOF Corrosion-Control Coating," *Journal of Thermal Spray Technology*, Vol. 12, No. 3, Sept. 2003, pp.403-415.
- L. M. Weinstein and G. S. Settles, "Schlieren," Chapter 4 of *Optical Metrology for Fluids, Combustion, and Solids*, ed. C. Mercer, Kluwer Academic Press, July 2003, ISBN 1-4020-7407-7.
- Settles, G. S., Benwood, J. R., and Gatto, J. A., "Optical Shock Wave Imaging for Aviation Security," presented at the 4<sup>th</sup> ASME/JSME Joint Fluids Engineering Conference, Honolulu, Hawaii, July 6-11, 2003
- Hartranft, T. J., and Settles, G. S., "Sheet Atomization of Non-Newtonian Liquids," *Atomization and Sprays*, Vol. 13, Nos. 2-3, March-June 2003, pp. 191-221.
- Settles, G. S., "True Confessions of an Experimentalist," Invited Paper # 2003-4271, AIAA Fluid Dynamics Conference, Orlando, FL, June 26, 2003.
- G. S. Settles, B. T. Keane, B. W. Anderson, and J. A. Gatto, "Shock waves in aviation security and safety," *Shock Waves*, Vol. 12, No. 4, Jan. 2003, pp.267-275.
- Settles, G. S., Kester, D. A., and Dodson-Dreibelbis, L. J., "The External Aerodynamics of Canine Olfaction," Chapter 23 of *Sensors and Sensing in Biology and Engineering*, ed. F.G. Barth, J.A.C. Humphrey, and T.W. Secomb, Springer, Vienna & NY, 2003, ISBN 3-211-83771-X, pp. 323-335.
- Hanson, T. C., Hackett, C. M., and Settles, G. S., "Independent Control of HVOF Thermal Spray Temperature and Velocity," *Journal of Thermal Spray Technology*, Vol. 11, No. 1, March 2002, pp. 75-85.
- Gary S. Settles, Heather C. Ferree, Michael D. Tronosky, and Zachary M. Moyer, and William J. McGann, "Natural Aerodynamic Portal Sampling of Trace Explosives from the Human Body," FAA 3<sup>rd</sup> International Symposium on Explosive Detection and Aviation Security, Nov. 26-30, 2001, Atlantic City, NJ.
- G.S. Settles, B.T. Keane, B.W. Anderson, and J.A. Gatto, "High-Speed Imaging of Shock-Wave Motion in Aviation Security Research," FAA 3<sup>rd</sup> International Symposium on Explosive Detection and Aviation Security, Nov. 26-30, 2001, Atlantic City, NJ.
- Settles, G. S., *Schlieren and Shadowgraph Techniques; Visualizing Phenomena in Transparent Media*, Springer-Verlag, Heidelberg, September 2001, ISBN 3540661557.
- Settles, G. S., and Kester, D. A., "Aerodynamic sampling for landmine trace detection," presented at SPIE Aerosense Meeting, Orlando, April 2001, SPIE Vol. 4394 paper 108.
- Settles, G. S., and McGann, W. J., "Potential for portal detection of human chemical and biological contamination," presented at SPIE Aerosense Meeting, Orlando, April 2001, SPIE Vol. 4378 paper 01.
- Settles, G. S., "Process Gas Nozzles," Section 4.8 of the *LIA Handbook of Laser Materials Processing*, ed. J. F. Ready & D. F. Farson, Laser Institute of America and Magnolia Publishing Inc., Orlando Florida, 2001, pp. 155-156.

- G. S. Settles, B. T. Keane, B. W. Anderson, and J. A. Gatto, "Shock waves in aviation security and safety," Proc. of the 23rd Intl. Symposium on Shock Waves, July 2001, Fort Worth, TX.
- Settles, G. S., "Airflow Visualization in a Model Greenhouse," Proc. Plasticulture 2000, Proc. 15th Intl. Congr. for Plastics in Agriculture, Hershey, PA, Sept. 2000, pp. 88-98.
- Kegerise, M. A., and Settles, G. S., "Schlieren Image-Correlation Velocimetry and its Application to Free-Convection Flows," presented at the 9<sup>th</sup> International Symposium on Flow Visualization, Edinburgh, Scotland, Aug. 2000.
- Gowadia, H. A., and Settles, G. S., "The Natural Sampling of Airborne Trace Signals from Explosives Concealed upon the Human Body," *Journal of Forensic Sciences*, Vol. 46, No. 6, Nov. 2001, pp. 1324-1331.
- S. P. Mates and G. S. Settles, "The Gas-Dynamic and Metal Atomization Performance of Two Different Close-Coupled Nozzles," in *Powder Materials: Current Research and Industrial Practices*, Ed. F.D.S. Marquis, The Minerals, Metals and Materials Society, Warrendale, PA, 1999, pp.19-38.
- Settles, G. S., "Imaging Gas Leaks by using Schlieren Optics," *Pipeline and Gas Journal*, Vol. 229, No. 9, September 1999, pp. 28-30.
- Settles, G. S., "Schlieren and Shadowgraph Imaging in the Great Outdoors," Proceedings of the 2<sup>nd</sup> Pacific Symposium on Flow Visualization and Image Processing, May 16-19, 1999, Honolulu, USA.
- Bemis, B. L., and Settles, G. S., "Ultraviolet Imaging of the Anode Attachment in Transferred-Arc Plasma Cutting," *IEEE Trans. on Plasma Science*, Vol. 27, No. 1, Feb. 1999, pp. 44-45
- Hartranft, T. J., and Settles, G. S., "High-Pressure Sheet Atomization of Non-Newtonian Fluids," Proceedings of the ILASS-Americas 12<sup>th</sup> Annual Conference on Liquid Atomization and Spray Systems, May 16-19, 1999, Indianapolis, IN.
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